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A New Nematode causing Parasitic Gastritis in Calves

BY

A. L. SHEATHER, B.Sc., M.R.C.V.S.,
Director and First Bacteriologist,
Imperial Bacteriological Laboratory, Muktesar.

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A New Nematode causing Parasitic Gastritis in Calves.

(Received for publication on 31st August, 1918.)

THE parasite that is the subject of this note was found in immense numbers in the fourth stomach of several calves which had died shewing all the symptoms usually associated with parasitic gastritis, and there can be no doubt that it was responsible for the deaths.

The cases from which the specimens were obtained occurred in a small dairy herd in December, 1917, but pressure of other work prevented a detailed examination of the parasite at the moment. The worms were therefore preserved in normal salt solution to which one per cent. of formalin had been added. The description, measurements, and photographs are taken from these.

In measuring the length of the parasite, specimens were placed upon an accurately graduated slide in a few drops of the preserving liquid and the length read off directly. The thickness of the body was measured under a microscope. No coverglass was used; the worms were therefore not subjected to any pressure.

The measurements of other details of structure and the photographs cannot be accepted as accurate indications of size, as the parasites from which they were taken were under coverglasses and therefore subjected to some amount of pressure. In some cases considerable pressure had to be exerted in order to render certain details distinctly visible.

Male Worm. The male parasite ranges from 16 to 22 millimetres in length, with an average of about 20 millimetres.

The body attains its maximum thickness of about 0·4 millimetre, some 2 millimetres from the anterior end. For about 6 millimetres the thickness remains constant, posterior to which it decreases slightly, and at the hinder end of the body the thickness is about 0·3 millimetre.

At a distance of about 0·5 millimetre from the anterior end the body shews a small papilla on either side (Plate I, fig. 1). These are short, pointed, and directed very slightly backwards, and arise from saucer. like depressions in the cuticle.

The cuticle shews fine transverse striations throughout. These are most distinct along the thickest part of the body where they are about 2 microns apart. There are some eighteen longitudinal striations on each surface of the body.

In a fully grown male worm the cuticle is practically constant in thickness throughout except in the obtuse angle formed by the posterior end of the body and the wing of the bursa, where it shews distinct thickening (Plate IV, fig. 8*). In worms which do not appear to have attained their maximum size the cuticle is also somewhat thickened for a short distance at the anterior end of the body.

The œsophagus is club-shaped and measures 1·6 millimetres in length.

The intestine is straight.

The spicules present some special features. They are remarkably long and slender, measuring in a worm of average size (20 millimetres) nearly 6 millimetres (Plate I, figs. 2 and 3).

For the greater part of their length they run in close company. Anteriorly they diverge slightly and are somewhat expanded to form funnel-like structures (Plate II, fig. 4). Attached to these are a pair of oval bodies which appear to have very thin walls, and which measure 0·2 millimetre in their longer (antero-posterior) diameter. These structures are composed of two parts, the more granular of the two fitting over the other like a cap. Extending forwards from each of these are two thin-walled tubes (Plate II, fig. 4). Slight pressure on the coverglass is sufficient to render the oval bodies invisible, apparently owing to rupture. Posteriorly the spicules also separate from each other for a short distance, but come together again at or near their extremities (Plate I, fig. 2, and Plate III, fig. 7).

At the posterior end of the body there is a blunt conical process measuring about 80 microns in length and rather less than that in diameter at its base—the genital cone.†

On each side of this cone there is a somewhat triangular wing-like structure, the base of which is opposite the apex of the cone (Plate II, fig. 5).

The bursa comprises two large lateral lobes and a small dorsal lobe which is symmetrically placed.

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* The figures on the various plates have been numbered consecutively.

† This and other names used to designate anatomical details are those used by Veglia in his "Report on the Anatomy and Life History of *Hæmonchus contortus.*" *Third and Fourth Reports (combined) of the Director of Veterinary Research, Union of South Africa,* Nov., 1915.

Owing to the spoon-like shape of the lateral lobes of the bursa, it appears to be impossible to flatten them out, while still attached to the body, for examination of the form and distribution of the supporting rays. It is, however, easy under a dissecting microscope to detach the large lobes and mount these separately.

In each lobe there are six rays and they are disposed as follows (Plate II, fig. 6):—

There is a single ventral ray (A) which measures about 200 microns in length, is curved ventrally and tapers gradually to a rather blunt point.

There are two long stout middle rays (B and C) which run together throughout their length. Of these the more dorsal is slightly the longer. These rays measure about 600 microns in length and 70 microns in width at their thickest part. The free ends are slightly expanded. Dorsally there are three slender and progressively shorter rays (D, E, and F). These all shew a general curve in the dorsal direction and range from 400 to 250 microns in length.

The most ventral of these (D) is always so curved as to bring its point close to that of the next ray (E).

The middle ray (E), although shewing a general curve in the dorsal direction, is usually slightly recurved at its tip. The most dorsal ray (F) is slender and more pointed than the other two.

The posterior lobe is, in the full grown worm, far smaller than the lateral lobes, but examination of male parasites that have not attained their maximum size shews that in these the posterior lobe is proportionately much larger (Plate II, fig. 5). The ray supporting this lobe (Plate III, fig. 7) has a stout, somewhat tapering main trunk from which arise two branches. Each of these terminates in two rounded tubercles, of which the outer is the larger. The inner tubercle frequently shews a small bud-like projection, and on the inner sides of the main branches there are frequently found a pair of similar projections.

On either side of the body just anterior to the attachment of the main lobes of the bursa, the subcuticular tissue shews a conical outgrowth about 15 microns in length (Plate II, fig. 5).

Radiating from points opposite the base of the genital cone on either side are bands of muscle fibres passing round the bases of the lobes of the bursa (Plate IV, fig. 8).

Female Worm. The female parasite ranges from 20 to 26 millimetres in length, with an average of 23·5 millimetres. The body is slightly thicker than that of the male and tapers to both extremities. Posteriorly the body terminates in a sub-acute tail which is curved slightly in the ventral direction.

The œsophagus and intestine are like those in the male. The anus opens at a point about 160 microns in front of the tip of the tail (Plate IV, fig. 9).

The vulva which takes the form of a transversely placed orifice with somewhat prominent lips is situated about 560 microns from the tip of the tail. No lingual appendage such as is found in *Hæmonchus* has been seen (Plate IV, fig. 9).

Extending forwards from the vulva is the vagina which runs a practically straight course and measures about. 2·8 millimetres (Plate V, fig. 10).

At its anterior end it makes a T-shaped junction (Plate V, figs. 11 and 12) with a short tubular structure which measures 250 microns in length (the unpaired part). This tube is placed more or less in the longitudinal axis of the worm, the vagina having therefore to make a right-angled bend to enable it to effect a junction with its middle point.

At each end of the unpaired part is an oval enlargement measuring about 140 microns in the long diameter. This appears to correspond with the " pars ejectrix " of the ovijector described by Veglia.

From each of these a tube about 480 microns long and with thick walls takes origin. That arising from the anterior one passes directly forwards and that from the posterior one making an immediate bend so as to pass forwards also.

A globular thickening (the " pars haustrix " of the ovijector, Veglia) marks the point where these thick-walled tubes are succeeded by thin-walled tubes of much larger calibre—the uteri. These measure about 3 millimetres in length.

Extending forwards from the uteri are the ovaries which in fully mature females are packed with eggs in various stages of development. No recognizable embryos were found in any of the eggs in the uteri. The ovaries run in company with each other and make four or five spiral turns round the intestine. They become gradually reduced in lumen and terminate blindly. The ovaries measure from 7 to 9 millimetres in length.

Identity of the Parasite.

A search through the literature has failed to reveal any reference to a nematode parasite having the characters of that described above.

According to Neveu-Lemaire* the nematode parasites of the fourth stomach and duodenum are comprised in six genera of the sub-family *Trichostrongylinæ*, namely :—

(1) *Hæmonchus*, Stiles 1903.

---

* Neveu-Lemaire. " Parasitologie des Animaux domestiques," 1912.

(2) *Graphidium*, Railliet & Henry 1909.
(3) *Nematodirus*, Ransom 1907.
(4) *Trichostrongylus*, Loos 1905.
(5) *Ostertagia*, Ransom 1907.
(6) *Cooperia*, Ransom 1907.

Species belonging to all these genera with the exception of *Graphidium* are found in the fourth stomach and duodenum of ruminants.

The following table shews the distinguishing features of these genera, and is based upon descriptions given by Neveu-Lemaire,* Macqueen,† and Pillers.‡ The corresponding features of the worm described in this note are given for comparison.

	Caudal bursa	Spicules	Vulva
Hæmonchus . .	Trilobed ; dorsal lobe asymmetrical	Short and stout with an accessory piece	$\frac{1}{5}$ to $\frac{1}{6}$ from posterior end of the body and covered by a lingual appendage
Nematodirus . .	Bilobed . .	Long and slender .	About $\frac{1}{4}$ from posterior end of the body
Trichostrongylus .	Bilobed . .	Short and twisted .	Near the posterior end of the body
Ostertagia . .	Median lobe insignificant or absent	Short and stout, and cleft at tips	$\frac{1}{10}$ from posterior end of the body
Cooperia . . .	Median lobe insignificant	Short and stout with accessory piece	$\frac{1}{4}$ from posterior end of body
Worm described in this paper	Trilobed with posterior lobe symmetrically placed	Very long and slender	Close to the posterior end of the body (about $\frac{1}{40}$)

From this it would appear that the parasite is not identical with any species previously recorded, and, further, that it does not fall into any of the established genera.

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* Neveu-Lemaire, loc. cit.
† Macqueen. "Neumann's Parasites," 2nd Edition, 1905.
‡ Wallis Hoare. "A System of Veterinary Medicine," Vol. II, 1915.

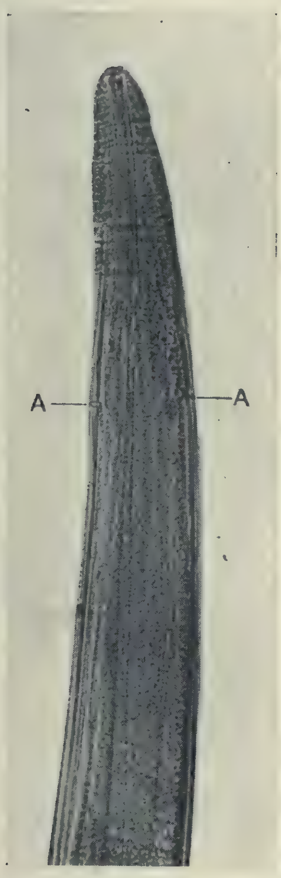

Fig. 1. Head of male × 75.
A, cervical papillæ.

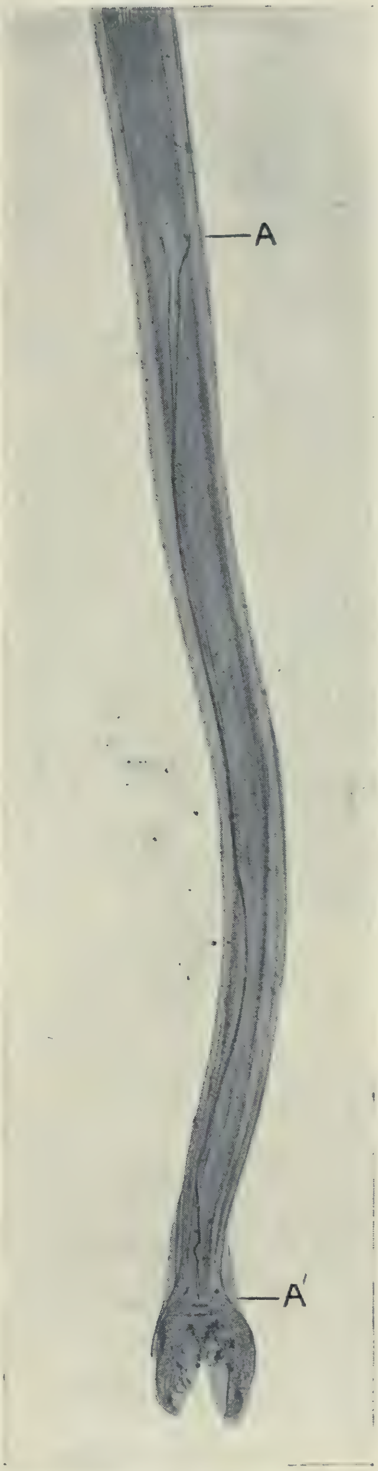

Fig. 2. Posterior part (about one-third) of male × 20.

A to A¹, spicules. The divergence at the anterior extremity is shewn at A, and the posterior divergence and reunion at A¹.

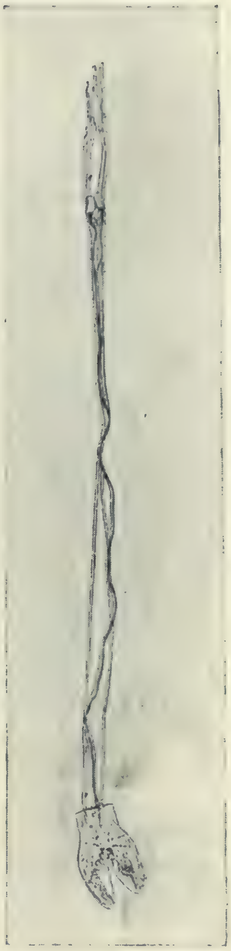

Fig. 3. Genital organs of male × 12·5.

It was found possible to extract these by tearing through the cuticle on either side of the worm close to the bursa with the point of an ordinary needle and by exerting gentle traction with the needle pressed flat on the bursa.

PLATE II

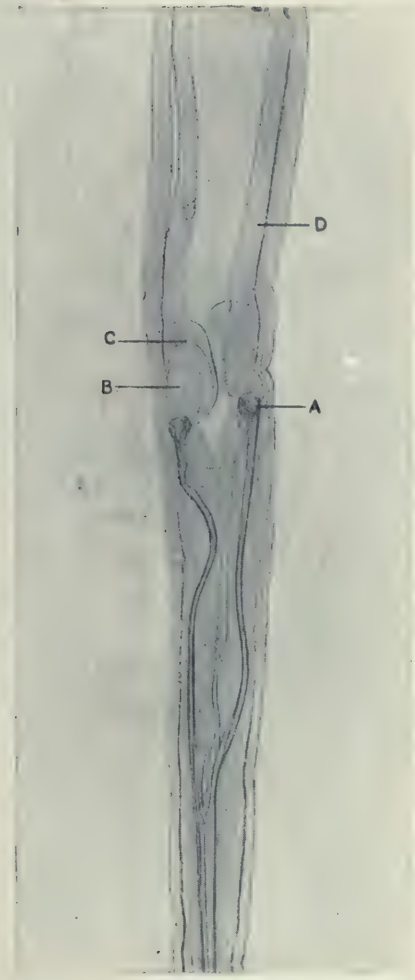

Fig. 4. Part of the male generative organs × 75.

A, funnel-like expansion of the anterior end of the spicule.
B, " oval body " attached to the spicule.
C, granular cap-like part of the " oval body."
D, thin-walled tubes running forwards from the " oval bodies."

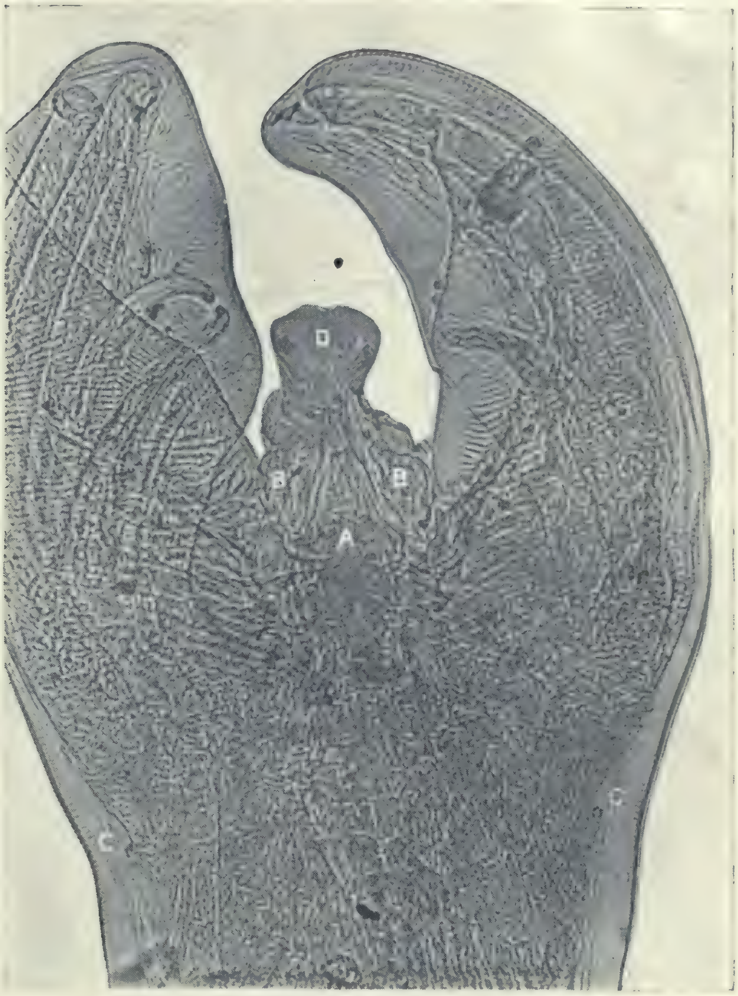

Fig. 5. Caudal bursa of male × 150.

A, genital cone.
B, B, triangular wing-like structures on each side.
C, C, positions occupied by the conical outgrowths.
D, middle lobe. The parasite from which this photograph was taken had not attained its full size; the middle lobe of the bursa is therefore proportionately large.

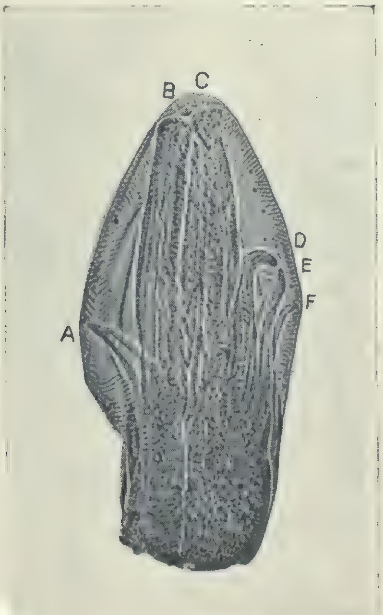

Fig. 6. Detached lobe of caudal pouch × 75.
A, ventral ray. B, C, middle rays.
D, E, F, dorsal rays.

PLATE III

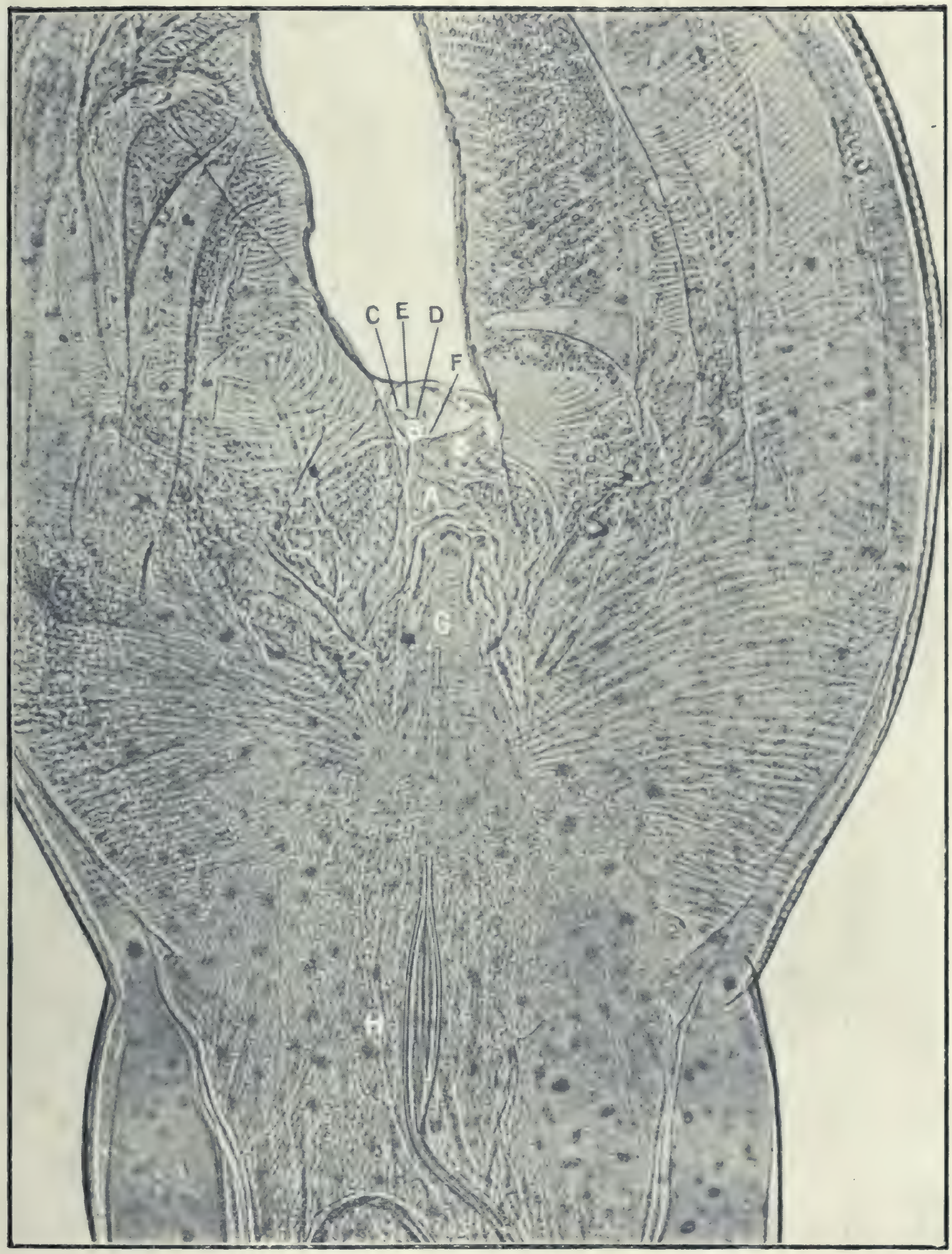

Fig. 7. Caudal extremity of male shewing the ray supporting the posterior lobe × 300.

A, main trunk.
B, B, primary branches.
C, outer tubercle of primary branch.
D, inner ,, ,, ,,
E, bud-like projection on inner tubercle.
F, club-like projection on inner side of primary branch.
G, genital cone.
H, terminal divergence and reunion of spicules.

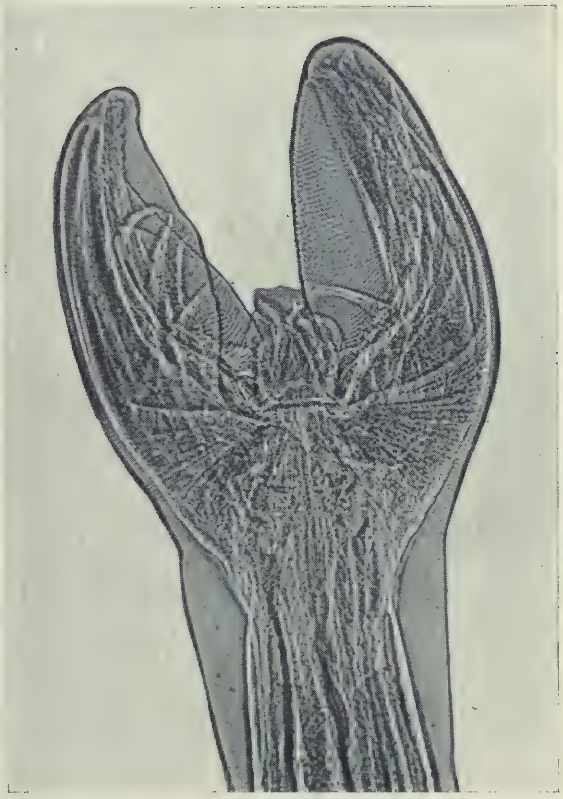

Fig. 8. Bursa of male worm × 75.
Showing muscle fibres radiating from opposite the base of the genital cone.

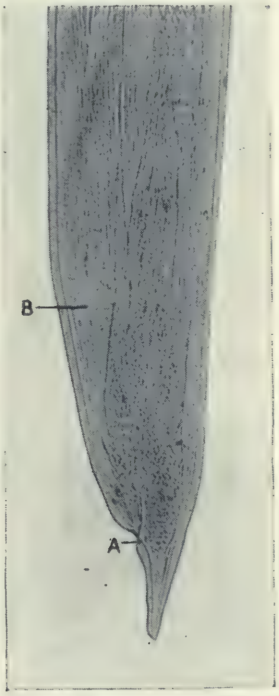

Fig. 9. Tail of female × 75.
A, anus.
B, vulva.

PLATE V

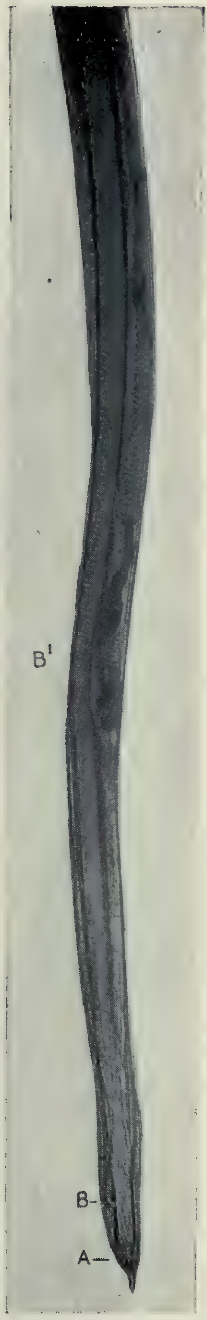

Fig. 10. Posterior part of female worm × 12·5.

A, anus.
B, vulva.
B—B¹, length of vagina.

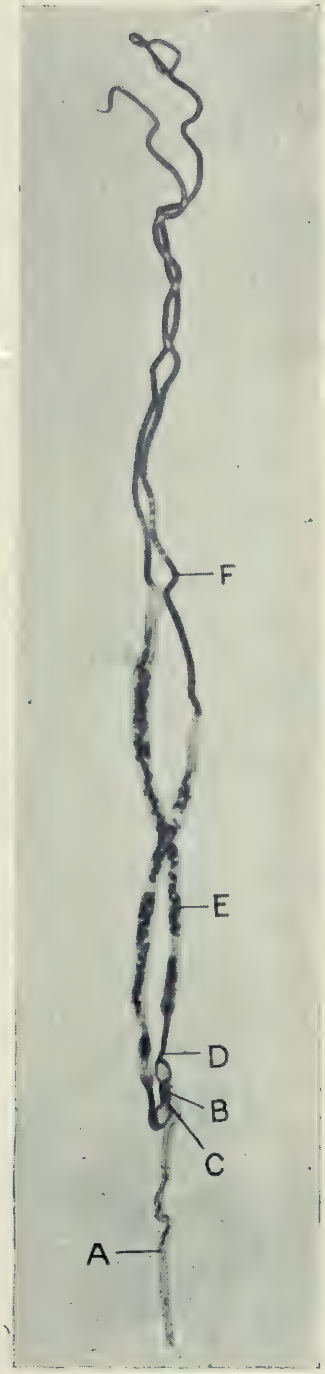

Fig. 11. Genital organs of female × 12·5.

A, vagina.
B, junction of vagina with "unpaired part."
C, "unpaired part."
D, ovijector.
E, uterus.
F, ovary.

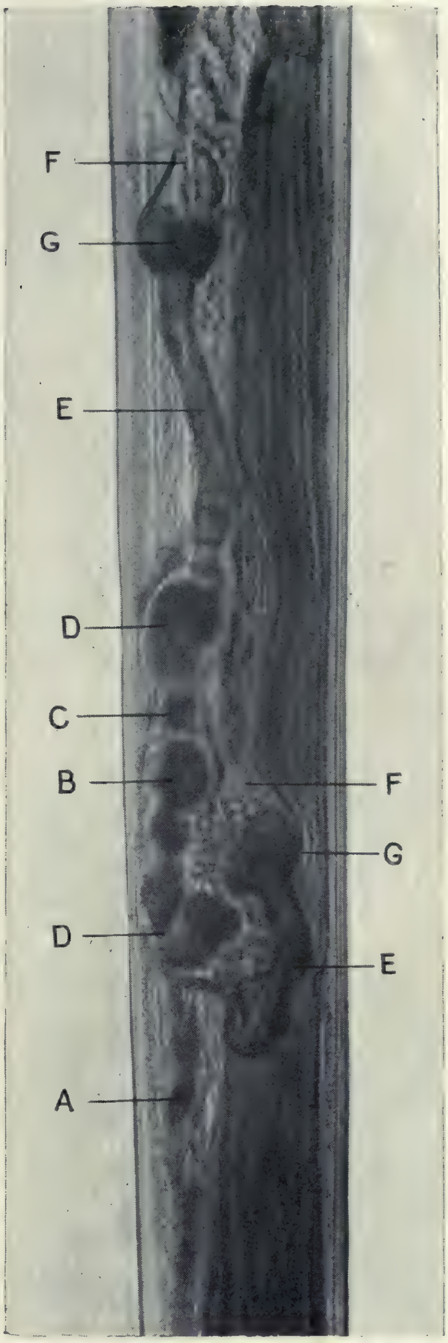

Fig. 12. Part of the genital organs of female × 75.

A, vagina.
B, junction of vagina with "unpaired part."
C, "unpaired part."
D, D, "oval enlargements."
E, E, "thick ovalled tubes."
F, F, uteri.
G, G, globular thickenings.

It was found possible to extract these in the following way :—

The anterior end of the worm was held under the slide clip of the dissecting microscope. The body was cut right across just in front of the vulva. By making "stroking" movements with the side of an ordinary needle pressed gently on the worm well forward in the body the intestine was divided without breaking the cuticle. By sliding the needle along the body the intestine and generative organs were extruded at the cut end of the worm and then separated from each other.

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